



Aeronautics

The Hummingbird: A Distributed Propulsion Concept

For subsonic to supersonic flight and hydrodynamic applications

A new engine concept from NASA's Glenn Research Center allows for truly distributed propulsion. The concept enables airframe and system modularity by allowing parts to be swapped or repaired easily. Design changes can be applied to individual components and not the entire propulsion system. The NASA Glenn innovation eliminates heavy shafts and disks and allows for airplane modularity as well. This design also enables subsonic to high supersonic flight with the same flowpath. If parts are damaged during flight, only a small percentage of thrust is lost. In addition, the blades can be retracted to enable ramjet or scramjet mode.

BENEFITS

- ➔ Efficient: The transition between subsonic and supersonic flight can be achieved with the same flowpath
- ➔ Versatile: The airframe can be modified to accommodate more or fewer passengers as needed
- ➔ Modular: The thrust/lift is not lost completely if there is damage to the propulsion
- ➔ Safe: Parts of the propulsion system can be jettisoned the case of emergency to lower weight

technology solution



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THE TECHNOLOGY

The novel NASA Glenn design replaces a conventional jet engine with a linear array of flapping blades and diffusing vanes for compression, a combustor, and a linear array of expansion ducts. These expansion ducts convert thermal energy to magnetic energy using reverse magnetic hyperthermia where the turbine ducts are lined with superparamagnetic composites that respond to thermal loads by generating alternating magnetic fields. The magnetic energy can be used to drive the electromagnetic actuators required for flapping. Kinetic energy is delivered to the air using rapid oscillations rather than by rotation. This is converted to internal energy by the vanes.

This is an early-stage technology requiring additional development. Glenn welcomes co-development opportunities.



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APPLICATIONS

The technology has several potential applications:

- ➡ Aviation propulsion
- ➡ Marine propulsion

PUBLICATIONS

Patent Pending

National Aeronautics and Space Administration

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